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Turbocharger Nomenclature and Terminology

RATIONALE

The technical report covers technology, products, or processes which are mature and not likely to change in the foreseeable future.

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Foreword—This reaffirmed document has been changed only to reflect the new SAE Technical Standards Board format.

1. Scope—This SAE Recommended Practice applies to nomenclature of turbocharger parts and terminology of performance.

2. References

2.1 Related Publications—The following publications are provided for information purposes only and are not a required part of this document.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE TSB 003—Rules for SAE Use of SI (Metric) Units
SAE J1349—Engine Power Test Code—Spark Ignition and Compression Ignition—Net Power Rating

2.1.2 OTHER PUBLICATIONS

"Principles of Turbomachinery," D. G. Shepherd, Macmillan, 1956
"Thermodynamics of Turbomachinery," S. L. Dixon, Pergamon, 1978

3. Definitions

3.1 Turbocharger—A device used for increasing the pressure and density of the fluid entering an internal combustion engine using a compressor driven by a turbine which extracts energy from the exhaust gas.

3.2 Compressor—The component of the turbocharger that raises the pressure and density of the inlet fluid.

3.3 Compressor Impeller (Rotor, Wheel)—The principal rotating component of the compressor which imparts energy to the fluid.

3.4 Compressor Diffuser—A component of the compressor in which the kinetic energy of the fluid leaving the impeller is partially converted to a rise in static pressure.

3.5 Compressor Housing—The housing that encloses the impeller(s) and diffuser(s), forms an inlet flow path to the impeller and collects the fluid leaving the diffuser for delivery to the engine.

3.6 Turbine—The component of the turbocharger that extracts energy from the exhaust gas of the engine and converts it to shaft work to drive the compressor impeller(s).

3.7 Turbine Rotor (Wheel)—The principal rotating component of the turbine which extracts energy from the exhaust gas.

3.8 Vaned Nozzle—An arrangement of stationary or moveable vanes for controlling the velocity of the exhaust gas relative to the turbine rotor.

3.9 Vaneless Nozzle—An arrangement in which the internal flow passage geometry of the turbine housing controls the velocity of the exhaust gas relative to the turbine rotor without the use of vanes.

3.10 Turbine Housing—The housing that encloses the rotor(s) and nozzle(s), directs exhaust gas into the nozzle(s) and forms an exit flow path from the rotor(s).

3.11 Wastegate—A valve that, when open, allows some of the exhaust gas to bypass the turbine rotor.

3.12 Clockwise and Counterclockwise Rotation—Direction of shaft rotation when viewed looking into the compressor inlet.

3.13 Variable Geometry Turbocharger—A turbocharger in which moving parts are used to alter the gas velocities and hence the performance of the turbine or the compressor, or both.

3.14 Turbocompounding—A method of increasing the power or efficiency, or both, of an internal combustion engine by means of a turbine which converts exhaust gas energy into shaft power and delivers it to the engine.

3.15 Series Turbocharging—An arrangement of two or more turbochargers with the compressors and turbines installed in series to increase the pressure and density of the fluid entering the engine.

3.16 Actuator—A device incorporated into a turbocharger assembly which controls the movement of the variable geometry component(s) or wastegate.

3.17 Bearing Housing—The housing that encloses and supports the bearing(s) and seals and makes provisions for lubrication and cooling.

4. Performance Terminology

4.1 Fixed Geometry Compressor

$$\text{Compressor pressure ratio} = \frac{\text{Outlet air static absolute pressure (kPa)}}{\text{Inlet air total absolute pressure (kPa)}} \quad \text{(Eq. 1)}$$

$$\text{Compressor air mass flow} = \text{kg/s of air mass flow through the compressor} \quad \text{(Eq. 2)}$$

$$\text{Corrected air mass flow} = \frac{\text{Compressor air mass flow} \times \frac{\sqrt{\text{Compressor inlet total absolute temperature (K)}}}{298\text{K}}}{\text{Compressor inlet total absolute pressure (kPa)} / 100\text{kPa}} \quad \text{(Eq. 3)}$$

$$\text{Corrected compressor speed} = \frac{\text{Compressor impeller speed (rpm)}}{\frac{\sqrt{\text{Compressor inlet total absolute tempereature (K)}}}{298\text{K}}} \quad \text{(Eq. 4)}$$